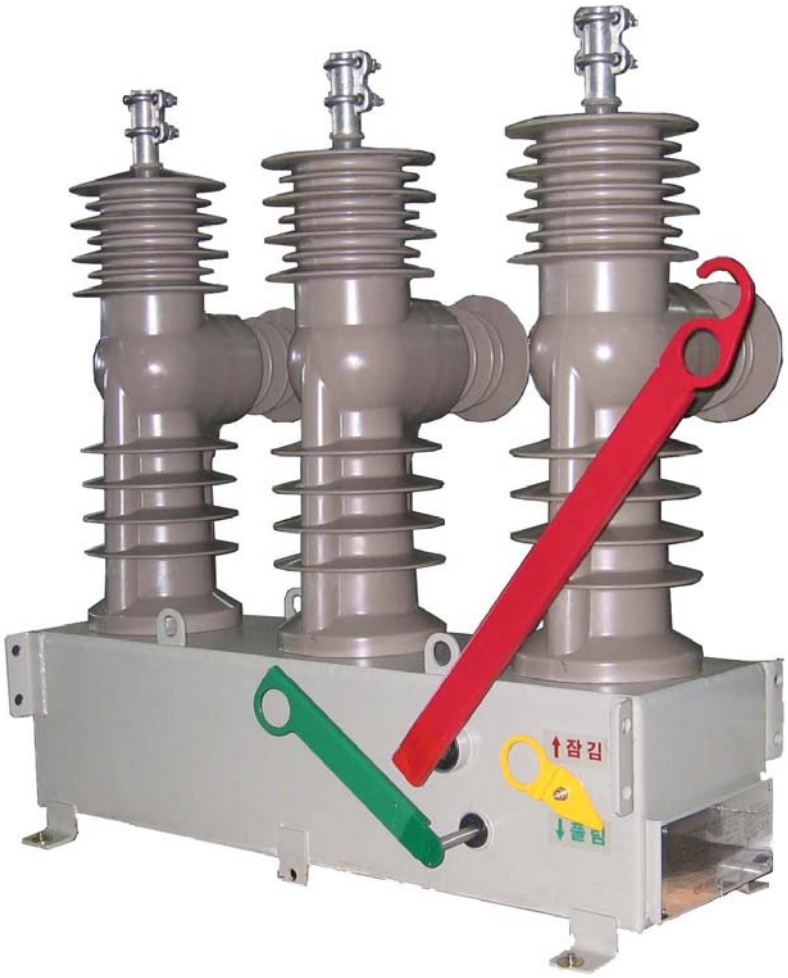
Polymer Insulated Fault Interrupters for 25.8kV Overhead Line

User's Manual



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1. **Introduction**

This is installed on feeder, wire or service entrance of consumer, in the branch point of below 16MVA load capacity. When over load or fault is occurred, it minimizes the damage and prevents the fault expansion by opening only the fault section with the cooperation of upstream protection equipment (CB, Recloser). Easy operation status monitoring is available by built-in load current indicator and live line status indication.

2. **Rating and Specification**

ITEM		**RATING**
Condition	Ambient temperature	-25 ℃ ~ 40 ℃
	Altitude	Below 1,000 M
Rated voltage [kV]		25.8
Rated current [A]		400
Rated frequency [Hz]		60
Rated short time current	Fast	15 kA
	1 sec.	12.5 kA
	10 sec.	3.5 kA
Rated making current		32.5kA (Peak)
Rated breaking current		12.5 kA(r.m.s)
Power frequency withstand voltage	dry	60 kV / 1 min.
	wet	50 kV / 10 sec.
Impulse withstand voltage (1.2×50㎲)		150 kV
Min. pickup current	PHASE	OFF, 50 ~ 630 A(Block), 5A Step
	GROUND	OFF, 25 ~ 315 A(By Pass), 5A Step
Cold Load Pickup		0.0 ~ 5.0 sec. (±10%), 0.1 sec. Step
Control Power	Battery	DC 24 V (12V7AH*2EA) 50 times or 24 hour (fully charged)
	External power	AC 220 V / 25 VA, Max.200 VA
Control box internal ambient test	Power frequency withstand voltage	2kV/1min
	Impulse withstand voltage	Voltage waveform:6kV,1.2/50μs Current waveform:3kA,8/20μs
	Surge Withstand Capability	EFT/BURST test: 4 kV(2.5 Hz) Oscillatory SWC test: 2.5 kV(1 MHz)
	Radiated electromagnetic interference withstand test	IEEE C37.90.2 35V/m

3. **Function and Characteristic**

When the fault current higher than Min. pickup current flows, automatic breaking is available according to the T-C Curve and if the upstream protection equipment is opened first it is spring charged regardless the T-C Curve. This is used for frequent lightning place, industrial line. the following functions are provided.

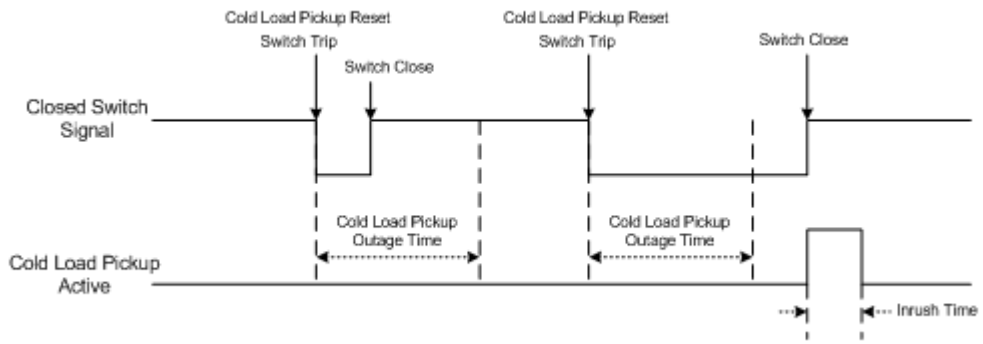
3.1. **Over-current Trip function**

This interrupter detects over-current and separates the fault section from the system when the upstream device protection equipment is opening the line. Besides, detects over-current and cooperates with the upstream protection equipment. OCR Trip, OCGR Trip function is provided.

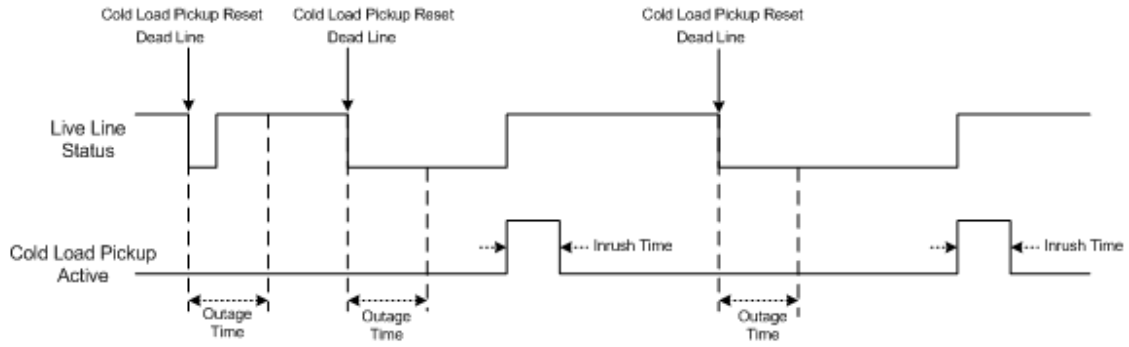
3.2. **Cold Load Pickup function**

Restrain the over-current Trip function and charge Trip function to prevent the malfunction by inrush current produced during the closing or when becomes live line by upstream protection equipment closing from dead line status.

After the interrupter is opened, if the interrupter is closed exceeding the 'Outage Time', this function is not operated, if the interrupter is closed after the 'Outage Time' this functions operates normally. Under the Interrupter closed condition, the line becomes dead line by upstream protection equipment and if the line becomes live line by reclosing within 'Outage Time' the Cold Load Pickup function does not operate.



< Figure 3-1> Cold Load Pickup function Operation condition in case of interrupter closing



< Table 3-2 > Cold Load Pickup function condition in case of Dead line status to Live line status

3.3. **Line current and Live line indication**

Each phase currents (A,B,C,N) are displayed on LCD of control box and Lamp that indicates the line status of source side (phase A) is provided.

3.4. **Easy function setting**

Min. pickup current, over-current lock current and other all setting can be set in LCD menu of control box.

3.5. **Battery discharge prevention**

Blocks automatically before the over-discharge of battery by AC power loss and prevents the damage. When AC power is applied, it returns to the normal operation.

4. Control Setting

The setting method of Interruptor control is the same as following.

4.1. **Minimum Pickup Current**

Easy Min. pickup current setting is available through control LCD menu.

4.1.1. PHASE Min. Pickup Current Setting

PHASE Min. Pickup Current is 2~3 times of Max. Load Current.

$$\frac{Contract\ (kW)}{22.9(kV)\times\sqrt{3}} \times (2 \sim 3\,times) = PHASE\ \ Min.\,Pickup\ Current$$

4.1.2. GROUND Min. Pickup Current Setting

Malfunction can be caused if Unbalance rate of three phase is big and GROUND Min. Pickup Current is smaller than Load Current. Therefore, GROUND Min. Pickup Current shall be set in 50% of PHASE Min. Pickup Current.

4.2. **Cold Load Pickup Setting**

Inrush Time and Outage Time can be set easily in LCD menu of control. Default value of Inrush time is 0.5 sec. and Default value of Outage Time is 3.0sec.

5. Operation description, function test, operation method

5.1. **Operation description**

5.1.1. When the fault current is over than Min. pickup current the upstream protection device does the delay operation, mostly the fault is removed directly by the interrupter because the CONTROL RESPONSE TIME of interrupter is fast. Sometimes the upstream protection equipment removes the fault depending on its setting.

5.2. **Operation function test**

This interrupter is set and tested completely before the delivery.

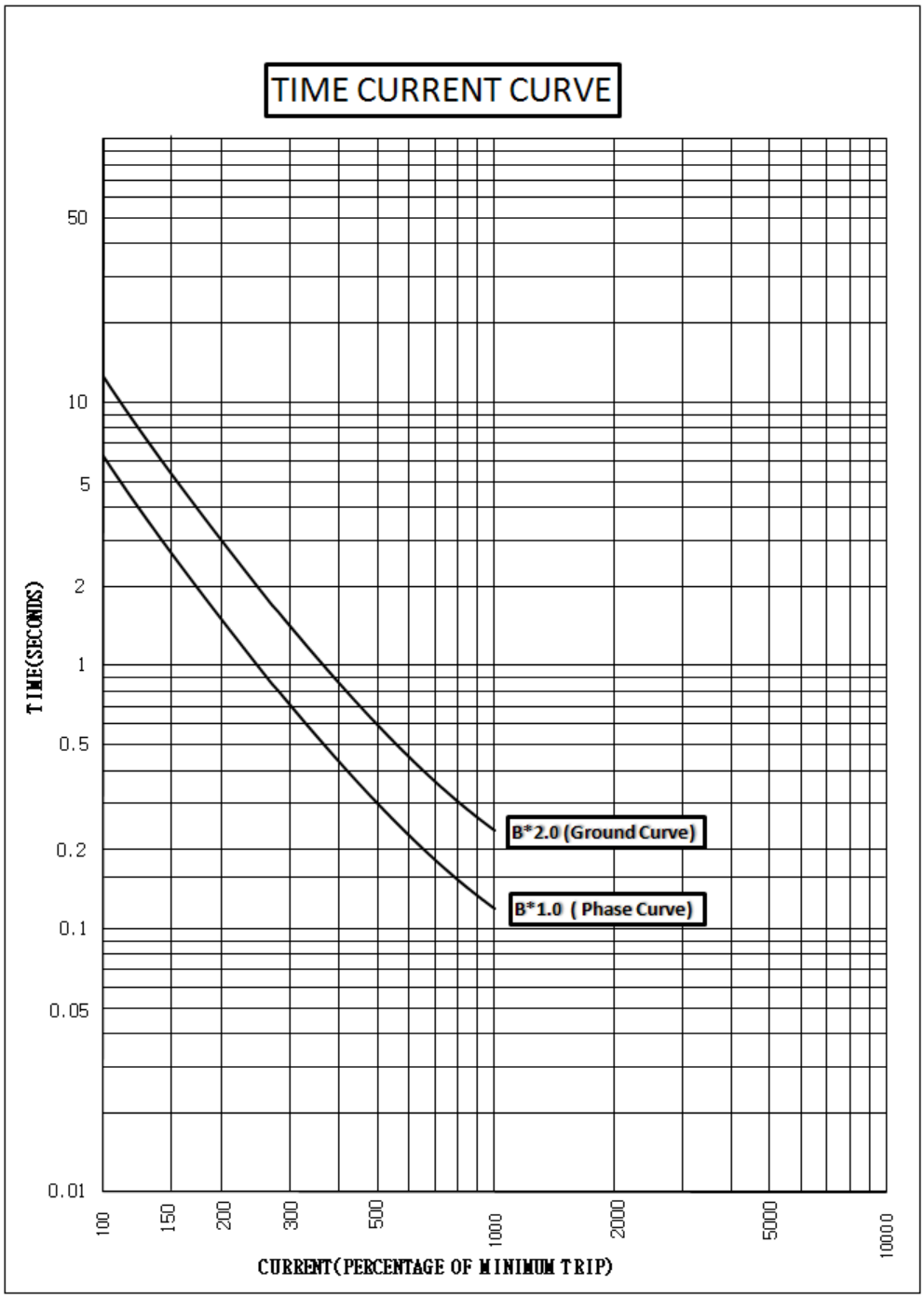
5.2.1. Min. Pickup Current test

The Min. Pickup Current test has ±10% accuracy.

5.2.2. Cold Load Pickup test (0.5sec SET status)

Apply current above the min. pickup current. If the current is interrupted within 0.45sec. it doesn't TRIP.

5.2.3. TCC Test (Setting curve at factory release)



-	150%	300%	600%
Phase Curve (B*1.0)	**2.643 sec.**	**0.707 sec.**	**0.228 sec.**
Ground Curve (B*2.0)	**5.286 sec.**	**1.414 sec.**	**0.456 sec.**

< Figure5-1 > TIME CURRENT CURVE

*. Refer to the Appendix for detail curve.

5.3. **Operation method**

5.3.1. Manual operation method

(1) CLOSE : Pull down the Close lever(red) one time. The lever is located on the right side of the interrupter body.

(2) OPEN : Pull down the Open lever(green) one time. The lever is located on the left side of interrupter body.

◎ Closing and opening by over force can damage the product.

5.3.2. Automatic operation method

Connect the interrupter with the control box by control cable.

Open the control box and check the battery voltage. The battery voltage shall be above DC 24V. If the battery is discharged, charge the battery first and then use it. (In case the battery jack is unplugged, connect the battery jack.)

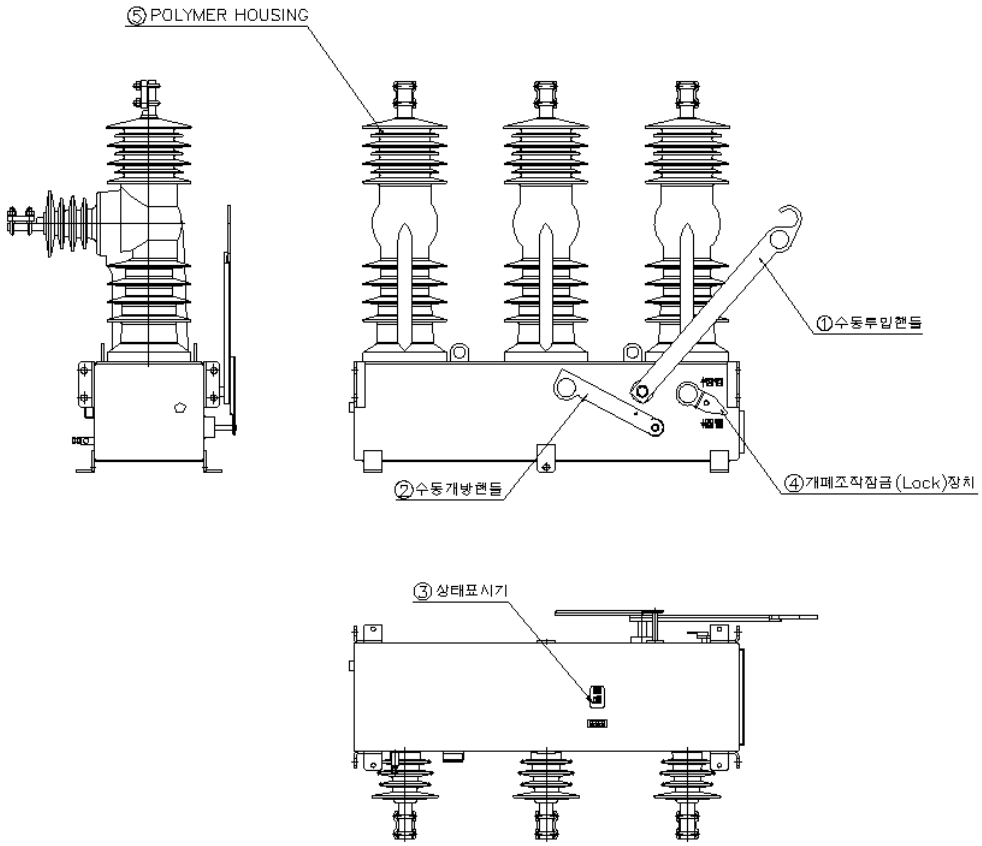
(1) Close: Press the close key.

(2) Open: Press the Open key.

(3) Set the setting value of control box according to the consumer.

6. **Name and description**

6.1.



① Manual Close Handle(Close)_Red

Hang the hot stick on the manual Close handle and pull it down. Then, the switch is closed.

② Manual Open Handle(Open)_Green

After the switch is opened, hang the hot stick on the manual Open handle and pull it down. Then, the switch is opened. If pull the handle down by over force, the interrupter may be damaged.

③ Status Indicator

Indicates the Open/Close status of the interrupter.

④ Manual Locking Device

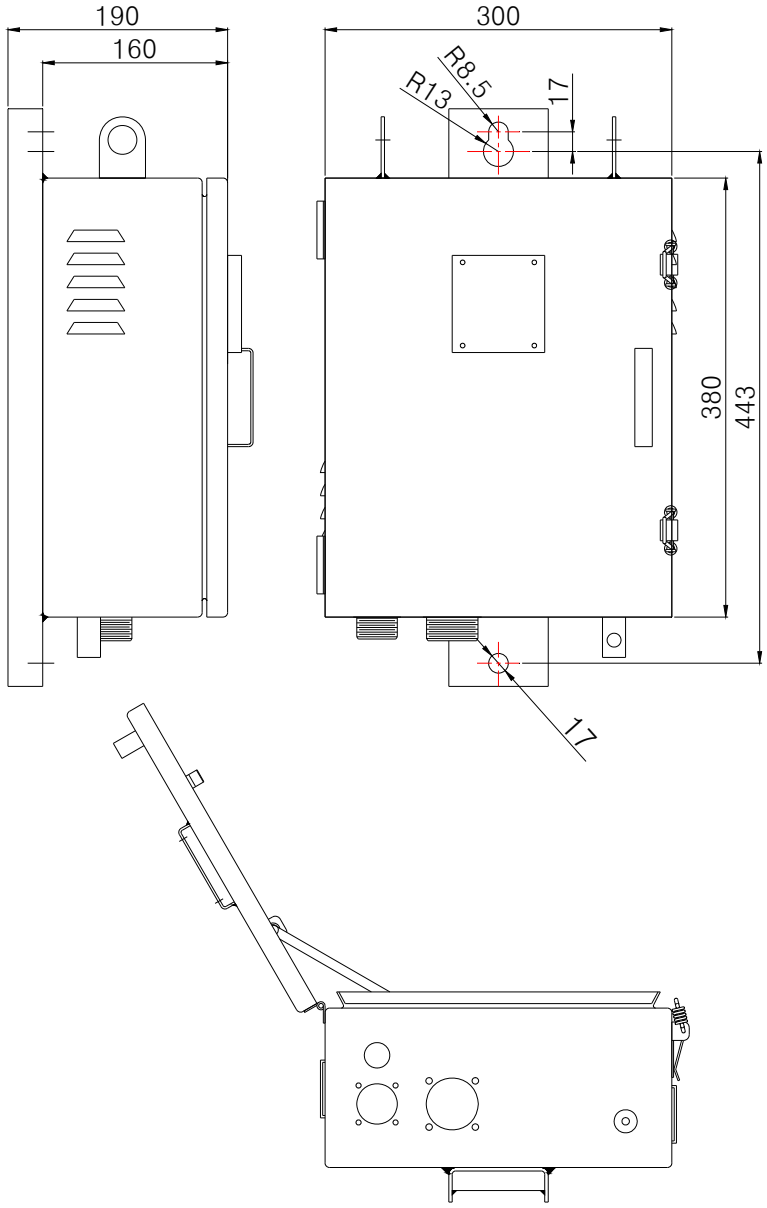
Electrical, mechanical closing is not available when pull the ring dow in opened status.

⑤ Polymer Housing

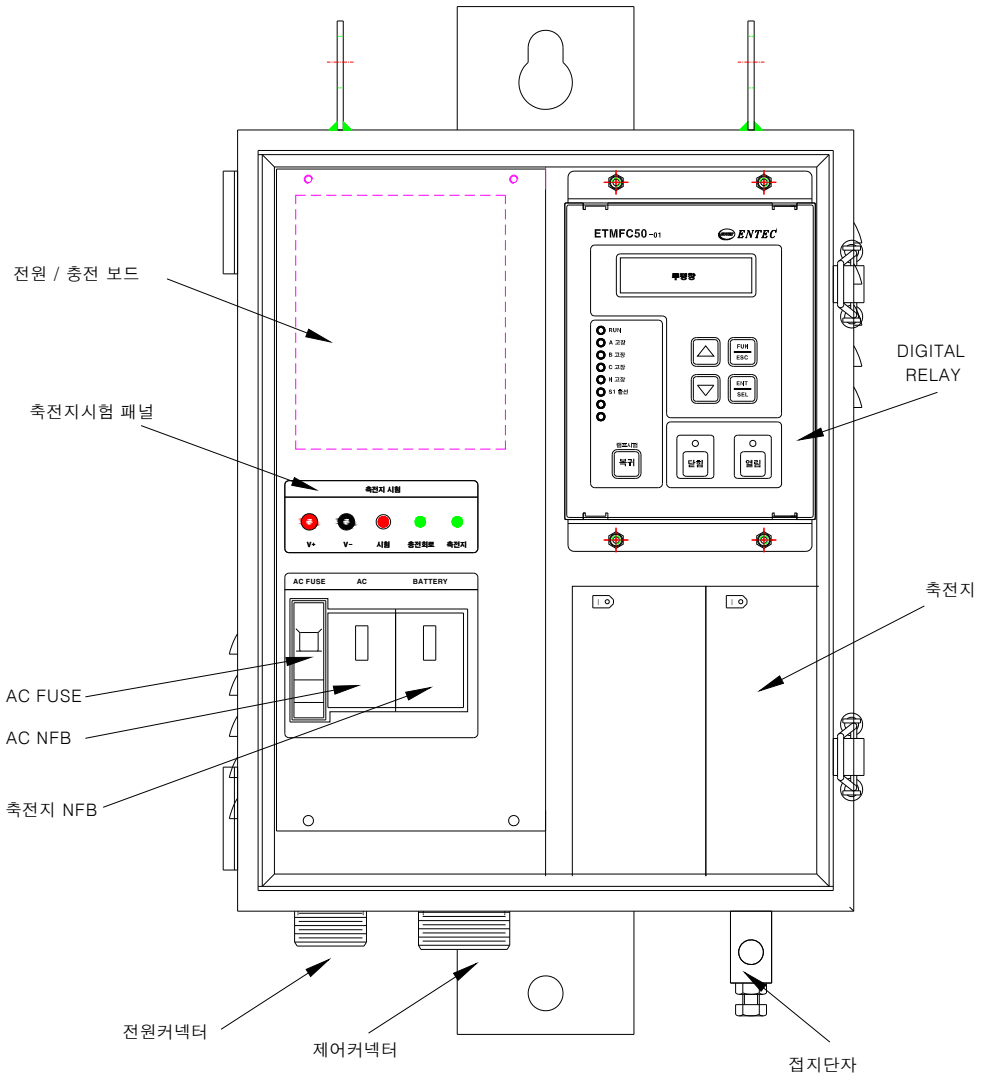
As the material is Epoxy, prevent the damage by impulse.

6.2. Control Box

6.2.1 Dimension

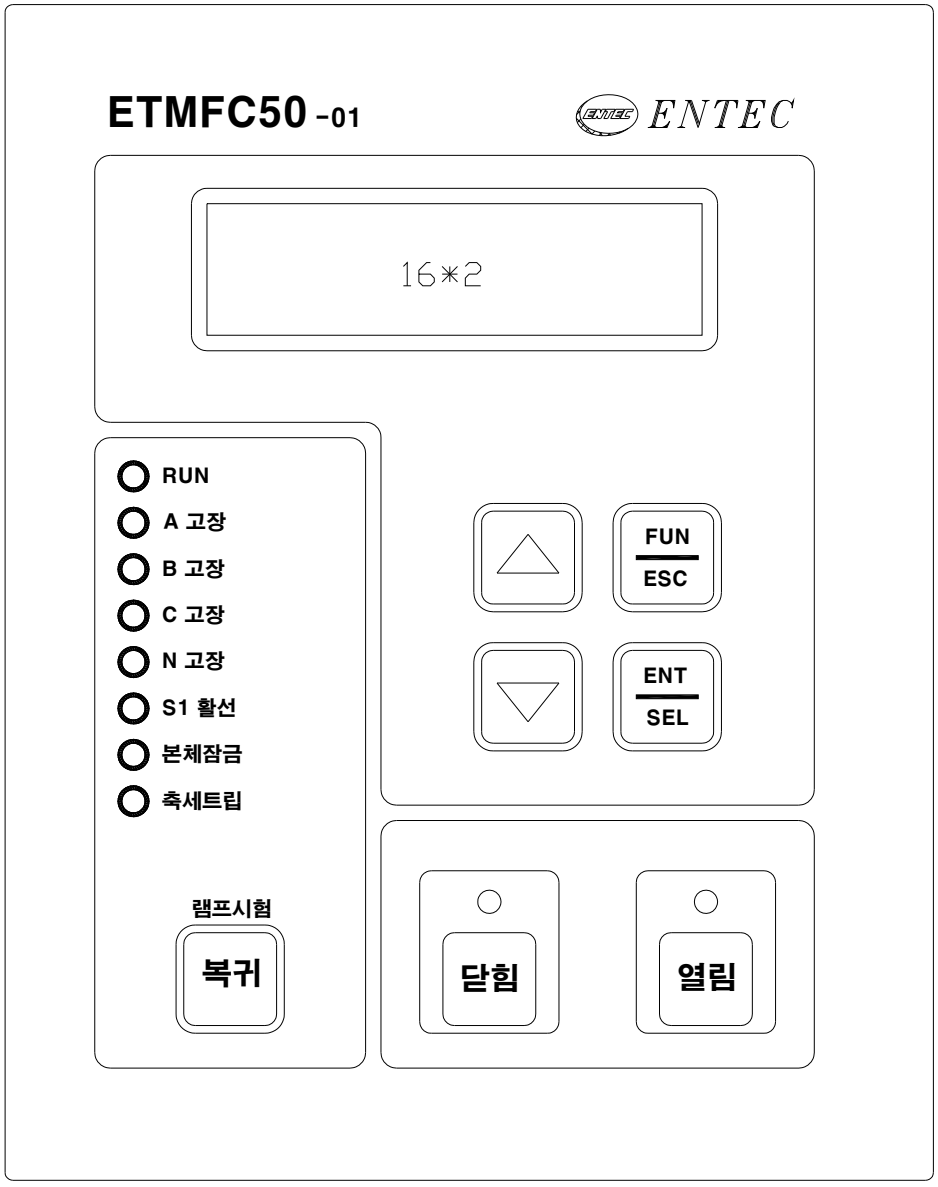


6.2.2 Structure



(1) Battery: DC24V(12V7AH 2units), dimension: L151*W65*H94.5(100)
(2) Battery NFB: 6A
(3) AC NFB: 6A
(4) AC FUSE: 2 A30mm (Slow blow type)
(5) Power TR: AC220V/24V
(6) DIGITAL RELAY :ETMFC50
(7) Power/Charging Board
(8) Power connector: MS22-2P(A:voltage side, B:ground side, C:not used)
* Power cable: It is 6meter. One side is female, the other side is wire.
(9) Control connector: MS28-22S
* Control cable: It is 8meter. This is made in female and male.

6.3 Control Panel



6.3.1 Close/Open Control section
Close/Open key and lamp: Close/Open operation is done by pressing this key.
CLOSE is indicated in Red and OPEN in Green.

6.3.2 Status Indicator Section

(1) RUN Lamp(Green): It blinks when the system is normal.

(2) A,B,C,N Fault Lamp(Red): The lamp turns on in case of Trip by fault and charge Trip.

(3) S1 live line Lamp(Red): Indicates the live line status of source side. Indicates the phase A(S1) of interrupter. Above 30%~50% of rated phase voltage is indicated as live line.

(4) Body lock Lamp(Red): Indicates manual locking status of the body. The interrupter does not operate ellectrically when the lamp is turned on.

(5) Spring charge Lamp(Red): Turns on in case of spring charge.

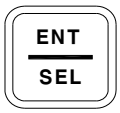
(6) Reset(Lamp test) key: All lamps are turned on when press this key. LCD message and lamp are reset after Fault and System Error indication. But, if the Fault and System error are maintained, the LCD message and lamp are not reset.

6.3.3 LCD Control Section

Setting change is available easily by using the control key. Besides, it can be done during the relay operation. The setting value is indicated on the LCD screen.

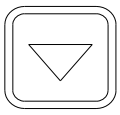
(1) LCD control key

: This key is used to move into the main screen from initial screen and to move to the main menu from submenu. Also is used to cancel after entering the setting and password.



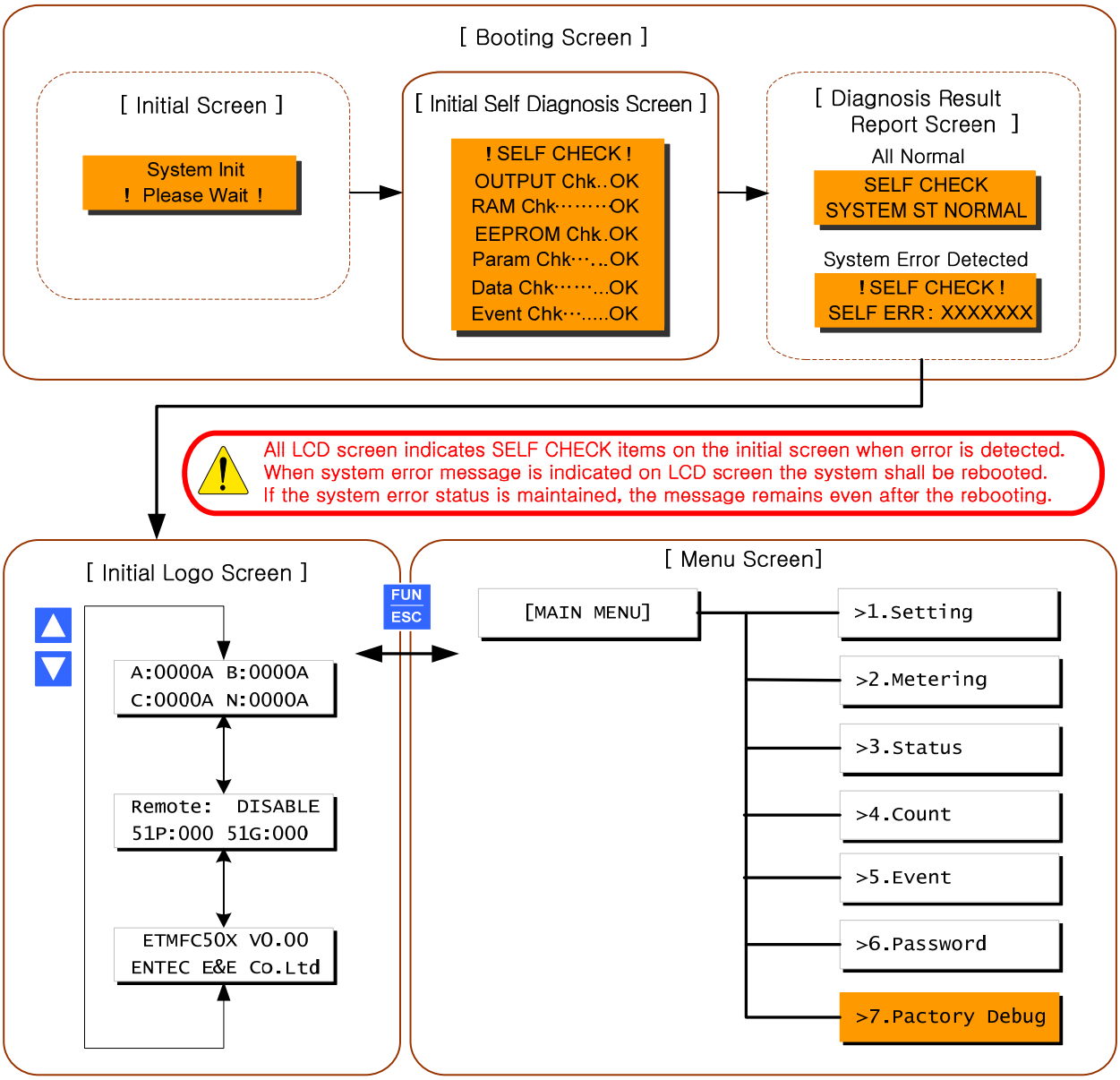
: This key is used to move into submenu or to change the setting value.

: This key is used to increase the setting value or to move the menu.


: This key is used to decrease the setting value or to move the menu.

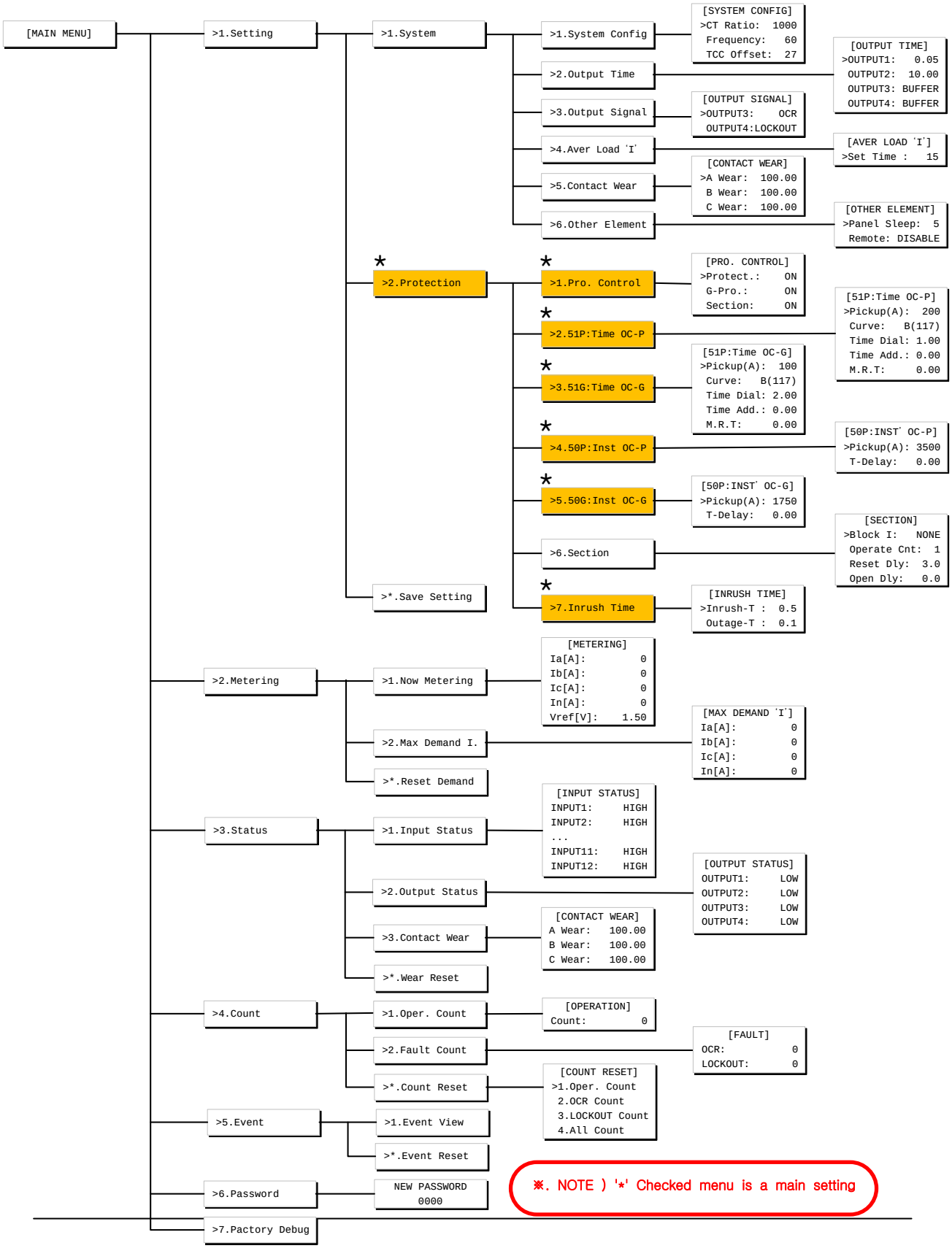
(1) LCD Display

16 x 2 characters LCD which has back-light support is provided. This provides easy check of operation status and control to the user.



< Figure 6-5 > LCD Initial menu

6.2.6 LCD menu structure and initial value.



(1) Setting

1) System Setting

● CT Ratio

- Sets the current CT ratio.
- Range: 1~1200 (1 step , Default: 1000)

※. Note) This setting value shall be same with the CT installed in the interrupter. Maintain the Default when the interrupter is released. This can affect the switch.

● Frequency

- Set the System frequency. Range: 50Hz, 60Hz

※. Note). Maintain the Default value when the switch is released.

● TCC Offset

- Set the time to operate promptly the relay in case of over-current
- Range: 0~100msec (1msec Step, Default: 27msec)

● Panel Sleep

- Set the sleep mode time. If there isn't a key pressing during this setting time, enters in to sleep mode.
- Range: 0(OFF), 1~100min. (1min. Step, Default: 5 min.)

● Remote

- Set the interrupter remote control through SCADA communication.
- Range: In case of ENABLE, DISABLE (Default: DISABLE)

※. Note) In case of ENABLE, IN06:OPEN, IN07: CLOSE,
IN08:RESET can be used.

2) OUTPUT signal setting

● OUTPUT Time

- Sets the OUTPUT contact signal time and outputs the PULSE signal during the setting time. When 0 is set(Buffer), outputs during the time that OUTPUT condition has occurred.
  * Range: 0(BUFFER), 0.01~60.00sec (0.01sec Step)

- OUT01 : It is fixed output. Outputs during the setting time under Open command or until finishing the opening. (Default: 0.05sec)
- OUT02 : It is fixed output. Outputs during the setting time under Close command or until closing the opening. (Default: 10.00sec)
- OUT03, OUT04 : Outputs the conditions set in “OUTPUT Signal“ and this device is not used.

● OUTPUT Signal
- Set the Output signal of OUTPUT3 and OUTPUT4.
- OUT3 Setting: NONE
- OUT4 Range: NONE
• NONE: Not used
• OCR: Over-current Trip occurrence (51P,51G,50P,50G)
• OCR51: Delay over-current Trip occurrence (51P,51G)
• OCR50: Instantaneous over-current Trip occurrence (50P,50G)
• LOCKOUT: Charge Trip occurrence
• CLOSED: Interrupter Close status
• OPENED: Interrupter Open status
• ALARM: System Error
• NORMAL: System Normal

3) Protection Function Setting
● Protection Control
- Protection: Select whether to use or not the phase and ground over current element.
  * Range: ON, OFF (Default: ON)
- Ground Protection: Select the use of Ground over current element. "Protection" shall be ON.
  * Range: ON, OFF (Default: ON)
- Section: Select whether to use or not the spring charge by section function.
  * Range: OCR I, BLOCK I, OFF (Default: OCR I)

● 51P: Time OC-P（Phase Delay Over-current element)
- Pickup: Sets the Pickup Current.
  * Range: 0(OFF), 50~630A (5A Step, Default: 200A)
- Curve: Sets the T-C Curve.
  * Range: Total 63types (Default: B(117))
- Time Dial: Sets the Time Dial of T-C Curve.
  * Range: 0.05~15.00 (0.01 step, Default: 1.00)

● 51G: Time OC-G (Ground Delay Over-current element)
- Pickup: 0(OFF), 25~315A (5A step, Default: 100A)
- Curve: Total 53types (Default: B(117))
- Time Dial: 0.05~15.00 (0.01 step, Default: 2.00)
- Time Add.: 0.00~10.00sec (0.01sec step, Default: 0.00sec)
- M.R.T: 0.00~10.00sec (0.01sec step, Default: 0.00sec)

● 50P: Inst OC-P (Phase Fast Over-current element)
- Pickup: Sets the Pickup current.
* Range: 0(OFF), 50~10000A (5A step, Default: OFF)
- T-Delay: Delay time is set.
* Range: 0.00~10.00sec (0.01sec, Default: 0.00sec)

※. Note) This interrupter does not use Phase Fast Over-current element.

● 50G: Inst OC-G (Ground Fast Over-current element)
- Pickup: 0(OFF), 50~10000A (5A step, Default: OFF)
- T-Delay: 0.00~10.00sec (0.01sec, Default: 0.00sec)

※. Note) This interrupter does not use Phase Fast Over-current element.

● Inrush Time
- Sets Inrush current restraint function.
- Inrush-T: Sets Inrush current restraint time.
* Range: 0.0~5.0sec (0.1sec Step, Default: 0.5sec)
- Outage-T: Sets Inrush current restraint function Outage time.
* Range: 0.0~180.0sec (0.1sec Step, Default: 0.1sec)

4) Save Setting: It is used to save the changed setting value.

(2) Metering
Indicates the present measured value of interrupter.
● Ia[A]: Indicates the measured current of Phase A.
● Ib[A]: Indicates the measured current of Phase B.
● Ic[A]: Indicates the measured current of Phase C.
● In[A]: Indicates the measured current of Phase N.
● Vref[V]: Indicates the internal standard voltage. The standard voltage is 1.5V.
*. Current bellow 2A is indicated in 0A.

3) Status
● INPUT Status: Indicates the INPUT status (IN01~IN12).
● OUTPUT Status: Indicates the OUTPUT status (OUT01 ~ OUT04).

(4) Count
Indicate the Count information of interrupter.
● Operation Count: It is switch operation count. It is calculated when the interrupter is opened.
● Fault Count: Indicates the number of Fault Trip Count of interrupter.
- OCR: Indicates the number of the Fault Trip Count by over-current element.
- LOCKOUT: Charge Trip count is displayed.

● Count Reset
- Operation Count Reset: Resets the Operation Count in 0.
- OCR Count Reset: Resets the OCR count in 0.
- LOCKOUT Count Reset: Resets the LOCKOUT count in 0.
- All Count Reset: Resets the Operation, OCR and LOCKOUT count in 0.

(5) Password
Changes the password.

(6) Factory Debug
This menu is for Manufacturer's maintenance purpose. User cannot access it.

7. Unpacking and Handling

7.1. Unpacking method

7.1.1. Before unpacking, check the packing status.
7.1.2. After unpacking, check whether the switch has damaged or not.
7.1.3. After unpacking, check if the information stated on name plate is correct.

7.2. Handling

7.2.1. To lift the interrupter, fix the wire rope in 4 lifting lugs and use the crane.
7.2.2. Maintain the device on flat ground to prevent deformation for temporary storage and handling.
7.2.3. Be careful to put the interrupter down on the ground to prevent the damage of interrupter by impact. It may cause breakdown.

8. Interrupter installation

8.1. Manual Switch control test

Pull down the right side of manual closing handle and the interrupter is closed. Pull the green manual TRIP and the interrupter is opened. Repeat 4~5 times and check the mechanical operation.

8.2. Automatic Switch control test

8.2.1. Press CLOSE key and the interrupter is closed after 6 sec. The interrupter is opened immediately when press OPEN key. When the interrupter is released from the factory, the battery is fully charged but it is not connected. Therefore, connect the battery PLUG and operates 4~5times of closing and opening before the installation.
8.2.2. The interrupter is packaged and released with the main body including the control box, power cable, control cable and installation brackets.

8.3. Precaution before installation

8.3.1. Unpack and check whether the interrupter and control box are damaged or not during the transportation.
8.3.2. Install the main body horizontally.
8.3.3. Install the interrupter during power outage condition. [Prevention of electric shock]
8.3.4. Manage the ground wire securely. [Ground terminal 22㎟～38㎟ wire access possible]

8.4. Switch installation

To install the interrupter on the pole, use the mounting bracket to lift and fix tightly with hanger bolt, hanger Bar and Clamp.
When install the interrupter onto the pole, use the mounting bracket to connect the ground line in the ground terminal of the interrupter and control box.
Connect the provided control circuit connecting Cable to the Receptacle.
Check if the Open status indicating Lamp is ON during power Switch ON of status Control panel and use after setting the phase current and ground current.

8.5. Cable installation

8.5.1. Power Cable: MS22-2S

※ A: Connects the voltage side(White), B: ground side(Black).

8.5.2. Control Connector: MS28-21S,P

※ Control Cable: It is 8meter and it is divided in female and male. Fasten the male to the control box by moving the aluminum body. Be care as the cable can be disconnected when swing.

9. Check and Maintenance

The checking number is influenced by the pollution and manual, automatic breaking count of interrupter. If it is automatically opened without fault current, check the following items periodically.

9.1. Battery check and change

9.1.1. Battery Check

DC 24V battery is provided. It is external power charge method. Therefore, external power AC220V shall be provided to control box.

9.1.2. Battery Change

BATTERY shall be changed periodically.

Battery is selling in our company or our agency. 2 batteries of ATLASBX KB7.0-12 type are used in series. In case of other company battery shall satisfy the below standard.

BATTERY: DC24V(12V7.0AH 2units), Size: L151W61*H94.5Max.100)

9.2. Periodic Check Point

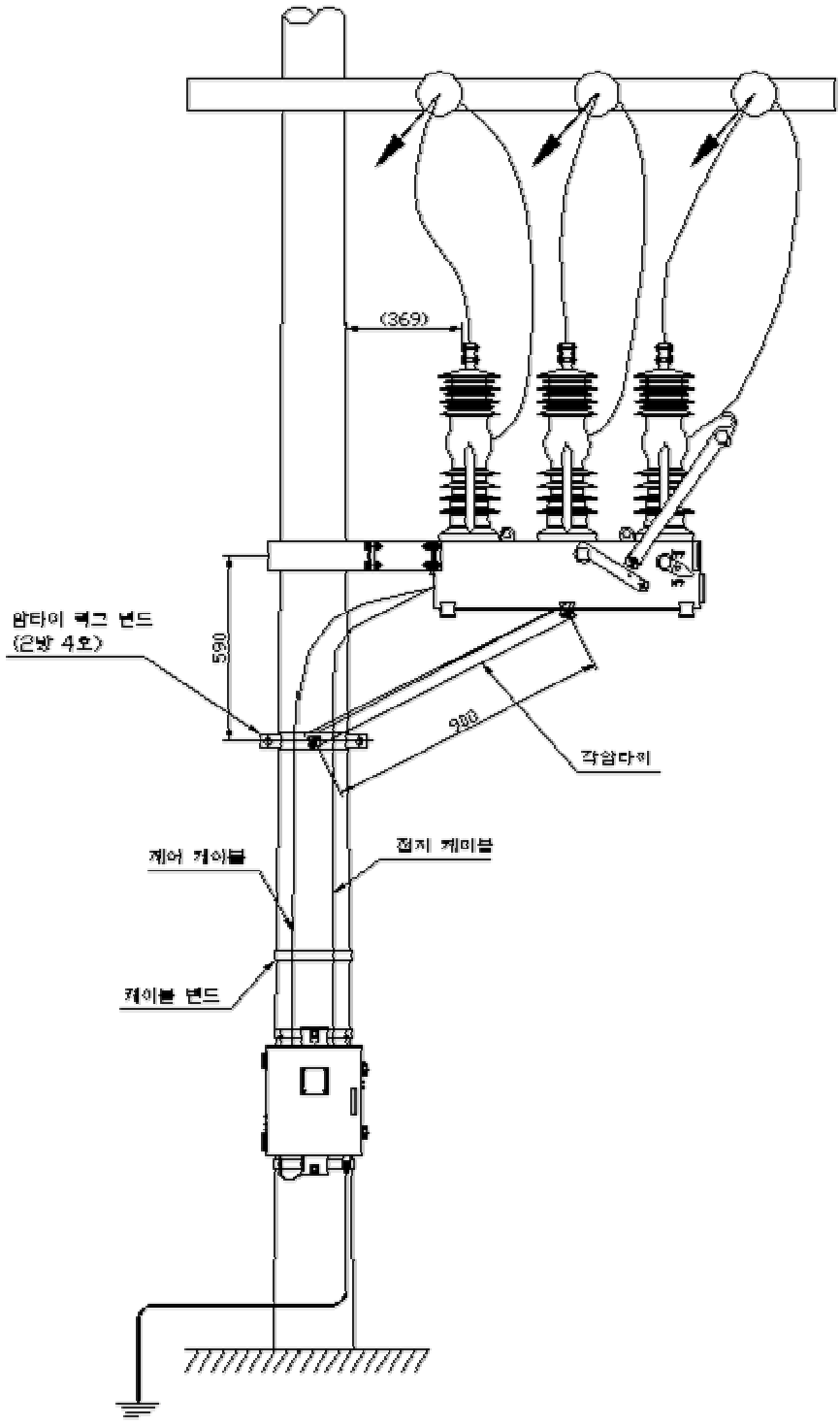
Check Point	Check period	Note
Damage and crack of Polymer Housing	6 months	Check if error is occurred.
Corrosion of Control box	6 months	Corrosion may cause malfunction.
Battery Voltage DC24V]	6 months	Replace in case of discharge [Warranty period 6months][life 2~4years]
Automatic Close/Open	6 months	Check if doesn't operate the Close/Open function.

9.3. Check point in case of fault occurrence

Description	Check point	Note
It does not close manually.	-Is the operating indicator closed?	When the rope is connected and is wet due to the rain, it can be tripped because its weight.
It does not open manually.	-Is the operating indicator opened? -Is the connecting loop is in vertical?	
It often opens.	-Does the connecting loop of opening side receive too many strength? -Is the min. pickup current set according to the load capacity?	It can be opened frequently if the fault current flows continuously.
It does not close automatically.	-Is the battery terminal closed? -Is the control cable connected? -Is the battery discharged? -Is the fuse in the control box is cut?	When the battery voltage is under DC24V, it is charged after 48hours of AC220V power input. [If the battery is completely discharged it shall be changed]
** Note: We don't provide the rope.*		
Please contact us in case of other problems. **TEL 031-299-8400 FAX 031-227-1164**		

10. Installation drawing

10.1. Installation drawing



11. Circuit diagram

11.1 Circuit diagram